

Preventing Accidents Caused by Unrecognized Roof Beam Failures in Underground Stone Mines—Iannacchione AT, Prosser LJ, Oyler DC, Dolinar DR, Marshall TE, Compton CS

A safer environment for stone miners can be realized by enhancing the industry's ability to recognize and monitor hazardous ground conditions. This is necessary because 12 of the 14 underground stone miner fatalities in the last six years were caused by falls of roof or rib. Because the total underground miner population is less than 2,000, the fatality incident rate is greater than for miners working in underground coal mines. Despite society's demand for the resultant products of stone mining, i.e., highways, buildings, agriculture, water purification, etc., the public typically opposes the development of surface stone quarries. Thus underground stone mines are emerging as an alternative method for producing needed raw materials within the tolerance level of the general public.

One technique under development by NIOSH at the Pittsburgh Research Center aimed at reducing the safety risk to miners is a remote monitor to detect hazardous ground conditions. Existing mechanical roof monitoring devices installed in drill holes have experienced only limited use in underground stone mines. These monitors are generally single point extensometers which measure the overall separation of roof layers in the immediate roof. Hazardous levels of roof sag signal a high potential for roof failure. In some cases this information has been used to add roof support, remove roof rock, or danger off affected areas. Unfortunately, these instruments are difficult to read because of their location on the roof line, require a considerable number to accomplish full coverage, and require considerable experience to determine dangerous sag rates. A new generation Automated Roof Monitoring Safety System (ARMSS) developed by NIOSH improves on the existing methods for determining roof stability. This mechanical roof sag monitor includes the following features: 1) inexpensive (<\$150), 2) multiple anchor points [a many as six], 3) adaptable to standard data acquisition systems, 4) easy to install, and 5) remote monitoring capability. At a recent field site test the following issues were examined: 1) what are critical sag rates?, 2) how much sag occurs prior to a roof fall?, 3) at what locations in the roof does the failure occur?, 4) how often should monitors be read?, 5) where should monitors be placed within the entry?, 6) when should monitors be used?, and 7) how should the monitor data be analyzed? This research will provide recommendations/guidelines on these issues so that this technology can be used effectively and efficiently in an effort to improve the safety conditions for underground stone miners.